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EXAMINER	
SHEVIN, MARK L	
ART UNIT	**PAPER NUMBER**
1793	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/506,416	BLUM ET AL.	
	Examiner	Art Unit	
	Mark L. Shevin	1793	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-19* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-19* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *13 May 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *11/01/2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Status

1. Claims 1-19, filed as a preliminary amendment on August 30th 2006, are pending.

Information Disclosure Statement

2. The reference with the line through it was not considered as it did not have a publication date, title, or other identifying bibliographic information beyond the author names.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. **Claims 1, 6, and 7** are rejected under 35 U.S.C. 103(a) as being unpatentable over **US '812** (US 6,019,812) in view of **Choudhury** (EP 1,006,205 – *using US 2003/0010472 A1 as English translation*).

Regarding claim 1, US '812 teaches that, in the content of titanium alloys (col. 1, lines 18-30), defect such as high density inclusions are introduced through

contamination of raw materials used for ingot production (col. 1, lines 31-36). Eliminating the final vacuum arc remelting step would provide significant economic advantages (col. 1, lines 63-65).

From Figure 1, raw material, 12, is fed into the plasma arc melting apparatus and flows through two refining pools, 22 and 26, heated by plasma torches, 24 and 28, and poured into a cold hearth for forming a billet / ingot.

The ingot is continuous cast, as the casting rate is monitored (col. 2, lines 54-57 and col. 4, lines 60-65).

US ‘812 does not, however, teach the billet is withdrawn from a cold wall *induction* crucible.

Choudhury teaches a process for the production of homogenous mixtures of alloys, in particular those of intermetallic phases of at least two alloy components (Abstract), in particular titanium compounds (para 0010). A melt is mixed in a cold wall induction furnace by magnetic fields (yields thorough mixing of elements - para 0007) and the resultant homogenized melt is drawn off continuously as rigid blocks (billet), (para 0009).

Choudhury distinguishes his invention over the prior art by stating that one of the prior art problems with vacuum arc remelting was the time and cost required (para 0004).

Thus it would have been obvious to one of ordinary skill in metallurgy, at the time the invention was made, taking the disclosures of US ‘812 and Choudhury as a whole, to combine US ‘812 in view of Choudhury to produce metallic and intermetallic alloy

ingots by continuous or quasi-continuous billet withdrawal from a cold wall induction crucible where the materials is supplied in a molten state for the following reasons:

Both references teach the importance of homogeneity in metallic and intermetallic ingot products. US ‘812 teaches that an advantageous way to increase chemical homogeneity is be using a plasma arc melting process (p. 10) where the molten TiAl material flows through two refining hearths and finally into an apparatus for continuous casting. Choudhury teaches that melts can be homogenized by using induced magnetic fields in a cold wall induction furnace prior to drawing off the billet. Although Choudhury deals with solid products being fed into his cold wall induction crucible, one of ordinary skill would be motivated to feed molten material from the Volas process into this Choudhury-type crucible as this crucible would yield a reasonable expectation of even further mixing, and thus higher final chemical homogeneity. Furthermore, the Volas plasma arc melting process improves chemical homogeneity, traps high density inclusions and yields finer, more equiaxed cast structures (p. 13) and these properties would lead one to combine the prior art processes as stated above.

Regarding claim 6, given the disclosure of cold wall induction furnaces in Choudhury, one of ordinary skill in the art would recognize the frequency and power levels as result effective variables effective in the melting and / or heating of metal and these frequencies and powers would vary depending on the material to be treated.

Regarding claim 7, given the disclosure of US ‘812 in flowing molten metal through refining zones, the temperature of such refining zones and of the melt pool will depend on the type of metal to be treated by the process and one of ordinary skill would

be able to optimize the melt temperature based on the material used. Furthermore, US ‘812 teaches that melt pool temperature plays an important role in the separation and refining of melt metal and is electronically monitored to measure process stability (col. 4, lines 45-56).

4. **<u>Claims 2 and 3</u>** is rejected under 35 U.S.C. 103(a) as being unpatentable over **US ‘812** in view of **Choudhury**, as applied to claims 1-2 above, in further view of **Guther(1)** (V. Guther et al. Processing of Gamma TiAl based ingots and their characterization. *Gamma Titanium Aluminides*, The Minerals, Metals and Materials Society, 1999, p. 225-230).

The disclosures of US’ 812 and Choudhury were discussed in the rejection of claim1 above, however, neither reference teaches applying the asserted process to TiAl materials.

<u>Regarding claim 2,</u> Guther(1) teaches the TiAl intermetallic alloys are a material in need of industrial-scale ingots with defined homogenous element distribution. Thus it would have been obvious to one of ordinary skill in metallurgy, at the time the invention was made, taking the disclosures of US ‘812, Choudhury, and Guther as a whole, to applied the process of US ‘812 in view of Choudhury to TiAl alloys as Guther(1) taught that such alloys need homogeneous ingots and both US ‘812 and Choudhury were designed to provide just such products.

<u>Regarding claim 3,</u> Guther(1) teaches: $Ti_xAl_y(Cr,Mn,V)_u(Nb,Ta,Mo,W)_v(Si,B,C)_w$ where y is between 45 and 48 at%, u, v, and w are between 0.1 and 3 at% and naturally x is 100-(y+u+v+w), namely the balance (p. 225, col. 2, para 1). Guther(1) further

teaches that local changes in the chemical composition influence both the microstructure and mechanical properties (p. 225, col. 2, para 1). Put another way, Guther(1) teaches the ingot composition to be an art recognized result effective variable depending on the microstructure and mechanical properties desired. It would have been obvious to one of ordinary skill in the art at the time of the invention to choose the instantly claimed ranges through process optimization, since it has been held that there the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. See In re Boesch, 205 USPQ 215 (CCPA 1980). Lastly, MPEP 2144.05, para I states: "In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a *prima facie* case of obviousness exists." It would have been obvious to one of ordinary skill in metallurgy, at the time the invention was made, taking the disclosures of US '812, Choudhury, and Guther(1), to utilize the TiAl of Guther(1) as Guther(1) teaches that the alloying additions as stated above, improve ductility, formability, tensile strength, creep resistance, oxidation resistance, and thus given the final product desirable physical / mechanical properties.

5. **Claim 4** is rejected under 35 U.S.C. 103(a) as being unpatentable over **US '812** in view of **Choudhury**, as applied to claims 1-2 above, in further view of **Guther(2)** (V. Guther et al. Recent improvements in γ – TiAl ingot metallurgy. 11^{th} AeroMat 2000, June 27th, 2000: Seattle, WA – in IDS) and **Gerling** (DE 19631583).

The disclosures of US '812 and Choudhury were discussed in the rejections above, however neither reference teaches inductively melting a pressed electrode.

US ‘812 teaches that the addition of a cold hearth melting as an initial refining step in an alloy refining process has been extremely successful in elimination the occurrence of HDI inclusions without the additional raw material inspection steps necessary in a triple VAR process (col. 1, lines 53-59). Eliminating a final VAR process would provide significant economic advantages (col. 1, lines 63-67).

Gerling teaches a method to produce a homogenous alloy in a simple manner, less expensive manner (p. 2, paras 4 and 5). This process involves the melting of a pressed powder electrode into a mold by energy provided by an induction coil (claim 1).

Choudhury adds that such pressed and compressed electrodes are joined together and melting in vacuum arc re-melting (para 0003), a more conventional fusion melting process when compared to the process of Gerling. Such electrodes are normally melted and remelted multiple times to achieve satisfactory homogeneity, incurring high cost and technical complexity (para 0003).

Guther(2) then adds a reasonable expectation of success in combining a vacuum arc remelting process, such as that of Gerling, with the plasma arc melting process of US ‘812 to yield improved ingot homogeneity. Guther(2) teaches the every additional melting step after the second VAR procedure results in enhanced aluminum homogeneity over the entire ingot (p. 22) and that the main objective in the near future is to reduce processing costs (p. 22). Specifically, plasma arc cold hearth melting (PACHM) was tested in a process that combining traditional VAR with plasma melting and this was shown to increase ingot homogeneity in a double arc remelted ingot (p. 19 and p. 15).

Thus is would have been obvious to one of ordinary skill in metallurgy, at the time the invention was made, taking the disclosures of US ‘812, Choudhury, Guther(2) and Gerling as a whole, to combine the four references to produce a highly homogenous alloy by the process of claim 4 for the following reasons:

Guther(2) teaches that conducting a plasma arc cold hearth melting step after vacuum arc remelting, instead of another vacuum remelting step, increases the homogeneity of TiAl ingots (p. 19 and p. 15). Both Guther(2) and Choudhury teach that these electrodes must first be pressed before melting (Guther(2) - p. 11 and Choudhury - para 0003).

US ‘812 adds that eliminating a final VAR process would provide significant economic advantages (col. 1, lines 63-67). Furthermore, US ‘812 teaches that the addition of a cold hearth melting as an initial refining step in an alloy refining process has been extremely successful in elimination the occurrence of HDI inclusions without the additional raw material inspection steps necessary in a triple VAR process (col. 1, lines 53-59).

Gerling teaches inductively melting a pressed electrode as having the benefits of simplicity and lower cost and thus one would be motivated by these expected benefits to incorporate such a process into one’s own homogenizing process.

Finally US ‘812 in view of Choudhury teach the final steps of homogenizing and withdrawing the melt, as discussed above. Choudhury homogenizes a melted material in his cold wall induction furnace using the stirring action of magnetic fields produced by the induction coils. The factors that tie the references together are the minimization of

cost and the maximization of ingot homogeneity. Furthermore, the ingots are of freely adjustable diameters and lengths as one of ordinary skill in the art would recognize these features as prime features of continuous casting as taught by US ‘812 and Choudhury.

Regarding claim 8, one of ordinary skill in the art would recognize the rotation speed of the electrode as a process variable that could be optimized depending on the type of material being inductively melted. Furthermore the rotation of electrodes in a melting process is well known (See GB 2265805). Thus it would be obvious to select a rotation speed based on the electrode material used in the process.

Regarding claim 9, both US ‘812 and Choudhury are fundamentally continuous processes and for example, looking at fig. 1 of US ‘812, is it clear that as the ingot is continuously withdrawn from the cold wall crucible, more metal must be melted to supply the continuously cast ingot with metal volume and thus it would have been obvious to one of ordinary skill to continuously supply the refining hearths of US ‘812 with metal as the process is continuously casting ingots and thus a continuous supply of molten metal is needed.

Regarding claim 10, given the disclosure of US ‘812 in flowing molten metal through refining zones, the temperature of such refining zones and of the melt pool will depend on the type of metal to be treated by the process and one of ordinary skill would be able to optimize the melt temperature based on the material used. Furthermore, US ‘812 teaches that melt pool temperature plays an important role in the separation and

refining of melt metal and is electronically monitored to measure process stability (col. 4, lines 45-56).

Regarding claim 11, given the disclosure of cold wall induction furnaces in Choudhury, one of ordinary skill in the art would recognize the frequency and power levels as result effective variables effective in the melting and / or heating of metal and these frequencies and powers would vary depending on the material to be treated.

Regarding claim 12, Choudhury teaches that a homogenized melt is drawn off continuously as rigid blocks from his cold wall induction furnace via an apparatus for drawing off blocks (para 0009). One of ordinary skill in the art, given this teaching would select standard continuous casting equipment such as water cooled copper segments as these are the same material as used in the bulk of the cold wall induction and because the copper provides very high heat conduction to the water cooling medium during operation.

Regarding claims 13 and 14, US ‘812 teaches the ingots from his process may range from 14 inches (35.56 cm) to about 30 inches (76.2 cm) in diameter with lengths up to 250 inches (635 cm) in this diameter range and thus teaches ingots with a L/D ratio of greater than 12 as at 14 inches diameter, any ingot longer than 168 inches meets this limitation. Guther(2) teaches that relatively small ingot diameters are generally required today yet these small diameters are much costlier to produce compared to larger diameters (p. 23).

With respect to the homogeneity, Guther(2) teaches that chemical homogeneity is a major influence on materials properties (p. 5) and that the Thermomechanical

properties mainly depend on microstructure where the deviation of alloying elements should be as small as possible (p. 6). Guther(2) shows both the absolute radial element deviation and absolute longitudinal deviation of Al, B, Cr, Nb, and Ta throughout the alloy. In particular. Guther(2) recommends that the Al deviation should be kept within ± 0.5 at% (p. 22). Thus it would have been obvious to one of ordinary skill in the art to create gamma-TiAl ingots with a L/D ratio above 12 and high homogeneity as claimed because Guther(2) taught that small ingot diameters are required and thus to maximize the process efficiency, one would be motivated to increase the total volume of material so that energy is not wasted in unnecessary heating of the melt pools while the cold wall induction crucible is not casting. Lastly, Guther(2) discloses ingots with a diameter of about 90 mm (p. 17).

6. <u>**Claim 5**</u> is rejected under 35 U.S.C. 103(a) as being unpatentable over **US ‘812** in view of **Choudhury**, as applied to claims 1-2 above, in further view of **Guther(2)** (V. Guther et al. Recent improvements in γ – TiAl ingot metallurgy. 11th AeroMat 2000, June 27th, 2000: Seattle, WA – in IDS). The differences in this process as compared to that of instant claim 4 or the absence of the electrode induction melting step and producing a pre-homogenized molten material in a cold-crucible plasma furnace in addition to a cold wall induction crucible.

The disclosures of US ‘812, Choudhury, and Guther(2) as discussed above. It would have been obvious to one of ordinary skill in metallurgy, at the time the invention was made, to combine US ‘812 in view of Choudhury and Guther(2) to form a homogeneous ingot by pressing electrodes, melting the electrode by a fusion method,

producing a molten material in an cold crucible plasma furnace, homogenizing in a cold wall induction furnace and finally continuously casting. This is because

Guther(2) teaches that conducting a plasma arc cold hearth melting step after vacuum arc remelting, instead of another vacuum remelting step, increases the homogeneity of TiAl ingots (p. 19 and p. 15). Both Guther(2) and Choudhury teach that these electrodes must first be pressed before melting (Guther(2) - p. 11 and Choudhury - para 0003).

US '812 adds that eliminating a final VAR process would provide significant economic advantages (col. 1, lines 63-67). Furthermore, US '812 teaches that the addition of a cold hearth melting as an initial refining step in an alloy refining process has been extremely successful in elimination the occurrence of HDI inclusions without the additional raw material inspection steps necessary in a triple VAR process (col. 1, lines 53-59).

From here, one has two VAR steps per the example given in Guther(2) beginning at p. 11. The ingot is homogenized in a plasma arc cold hearth as shown on p. 12, 17, and 18. From there one would be motivated to use the final process steps of US '812 in view of Choudhury as explained above because US '812 teaches that such plasma melting removes inclusions and Choudhury teaches that his cold wall induction furnace can further mix the melt using magnetic fields produced from his inductance coils. Again the ingots are freely adjustable in diameter and length as explained above.

Regarding claim 15, as stated before, one of ordinary skill in the art would recognize the rotation speed of the electrode as a process variable that could be

optimized depending on the type of material being inductively melted. Furthermore the rotation of electrodes in a melting process is well known (See GB 2265805). Thus it would be obvious to select a rotation speed based on the electrode material used in the process.

Regarding claim 16, as stated before, given the disclosure of US ‘812 in flowing molten metal through refining zones, the temperature of such refining zones and of the melt pool will depend on the type of metal to be treated by the process and one of ordinary skill would be able to optimize the melt temperature based on the material used. Furthermore, US ‘812 teaches that melt pool temperature plays an important role in the separation and refining of melt metal and is electronically monitored to measure process stability (col. 4, lines 45-56).

Regarding claim 17, as stated before, given the disclosure of cold wall induction furnaces in Choudhury, one of ordinary skill in the art would recognize the frequency and power levels as result effective variables effective in the melting and / or heating of metal and these frequencies and powers would vary depending on the material to be treated.

Regarding claim 18, as stated before, Choudhury teaches that a homogenized melt is drawn off continuously as rigid blocks from his cold wall induction furnace via an apparatus for drawing off blocks (para 0009). One of ordinary skill in the art, given this teaching would select standard continuous casting equipment such as water cooled copper segments as these are the same material as used in the bulk of the cold wall

induction and because the copper provides very high heat conduction to the water cooling medium during operation.

Regarding claim 19, Guther(2) discloses a plasma arc cold hearth melted ingot with a diameter of about 90 mm (p. 17). Furthermore, one of ordinary skill in the art would recognize that the diameter of the ingots can be optimized depending on the end needs of the metals customer. Furthermore, changes of size and proportion will generally not patentably distinguish a product over the prior art (See MPEP 2144.04, Sec IV(A).)

Conclusion

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

Spadafora (US 2002/0179278 A1)

Choudhury (GB 2,265,805)

-- Claims 1-19 (All pending) are rejected
-- No claims are allowed

The rejections above rely on the references for all the teachings expressed in the text of the references and/or one of ordinary skill in the metallurgical art would have reasonably understood or implied from the texts of the references. To emphasize certain aspects of the prior art, only specific portions of the texts have been pointed out. Each reference as a whole should be reviewed in responding to the rejection, since other sections of the same reference and/or various combinations of the cited references may be relied on in future rejections in view of amendments.

All recited limitations in the instant claims have been met by the rejections as set forth above. Applicant is reminded that when amendment and/or revision is required, applicant should therefore specifically point out the support for any amendments made to the disclosure. See 37 C.F.R. § 1.121; 37 C.F.R. Part §41.37 (c)(1)(v); MPEP §714.02; and MPEP §2411.01(B).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mark L. Shevin whose telephone number is (571) 270-

3588. The examiner can normally be reached on Monday - Thursday, 8:30 AM - 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy V. King can be reached on (571) 272-1244. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Mark L. Shevin/

/Roy King/

Supervisory Patent Examiner, Art Unit 1793

10-506,416
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